

# A Week-Two Probabilistic Fire Danger Outlook Tool Based on NCEP Ensemble Forecast System

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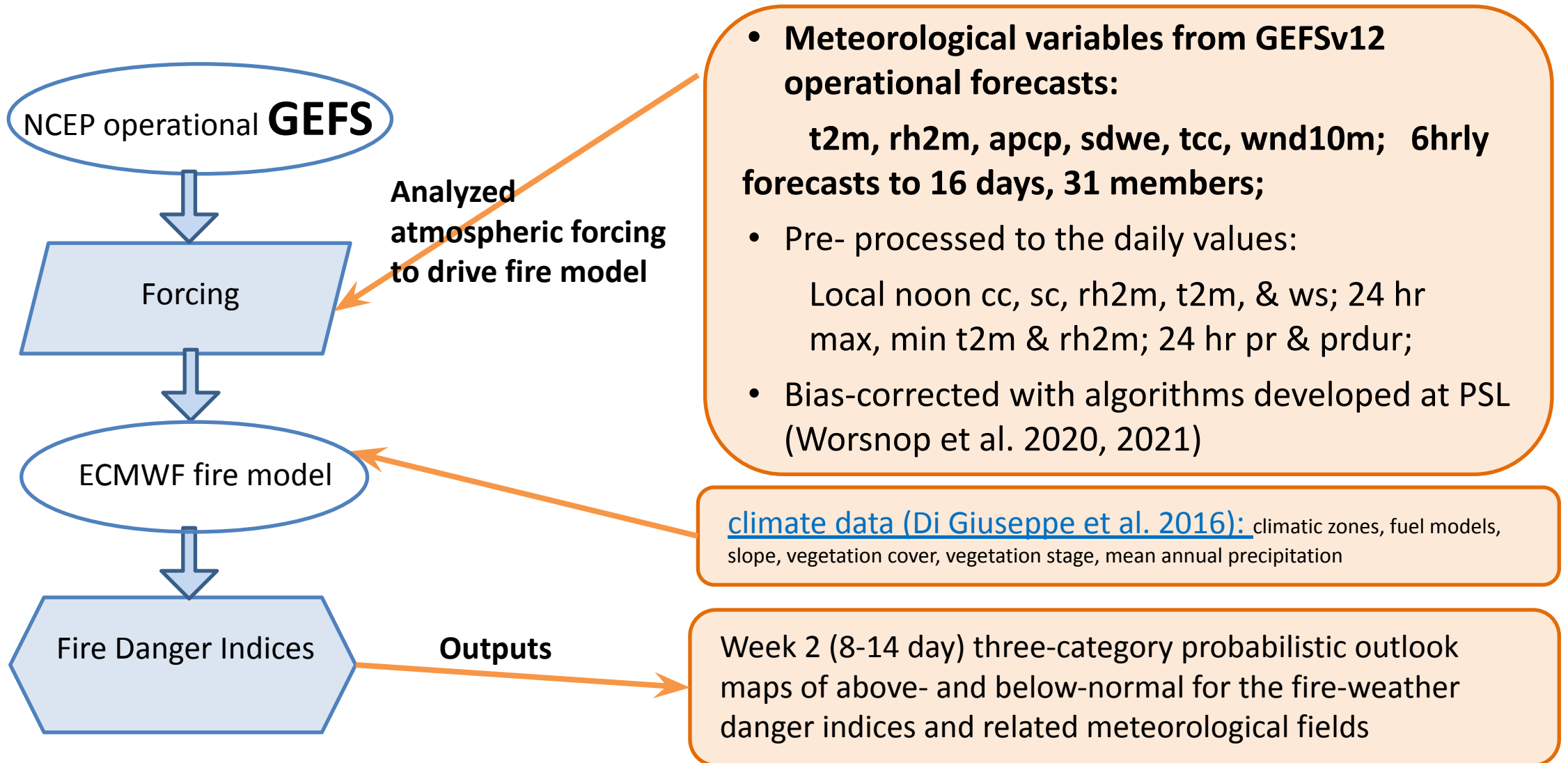
2) Cooperative Institute for Research in Environmental Sciences, Boulder, Colorado

3) NOAA/ESRL, Physical Sciences Laboratory, Boulder, Colorado

# Project Background

- Goal: provide state-of-the-science, reliable, skillful 8-14 day (week 2) guidance on wildfire potential hazards
  - The framework of the week 2 fire weather outlook tool was developed at NOAA Physical Sciences Laboratory (PSL) (Worsnop et al. 2020, 2021).
  - Use the Global ECMWF Fire Forecast (GEFF) model (Di Giuseppe et al. 2016) to simulate the fire danger indices.
- The outlook tool was implemented at CPC.
  - Run the outlook system on a real time basis since Aug. 2021.
- Potential customers:
  - NWS Fire Weather Program and Incident Meteorologists, National Interagency Fire Center and National Interagency Coordination Center, and other CPC customers.

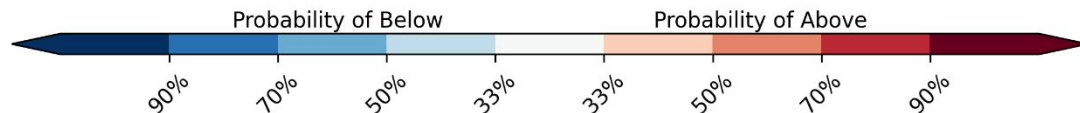
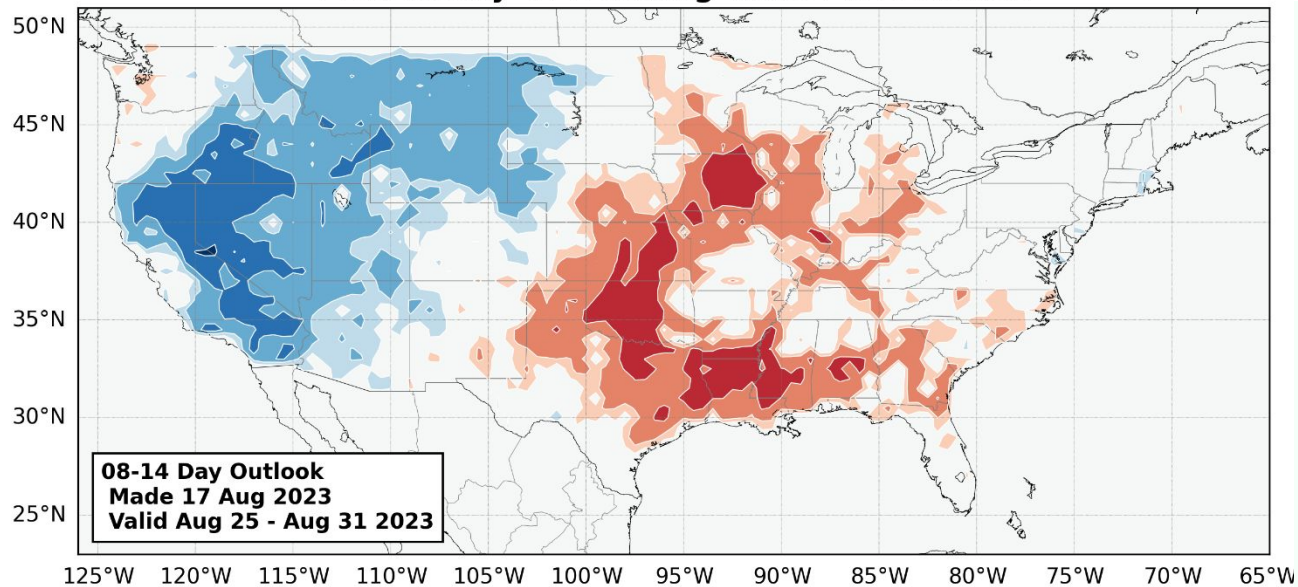
# The Week 2 Fire Weather Outlook System



# Real Time Monitoring Webpage

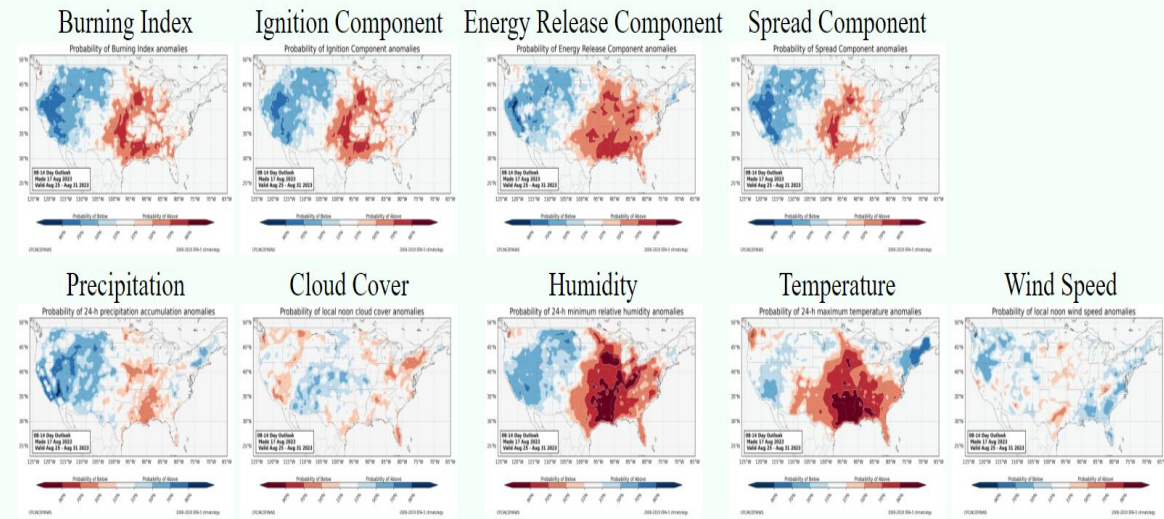
[https://www.cpc.ncep.noaa.gov/products/people/mchen/fireWeather/cpc\\_wk2fw\\_index.html](https://www.cpc.ncep.noaa.gov/products/people/mchen/fireWeather/cpc_wk2fw_index.html)

Probability of Burning Index anomalies



CPC/NCEP/NWS

2000-2019 ERA-5 climatology



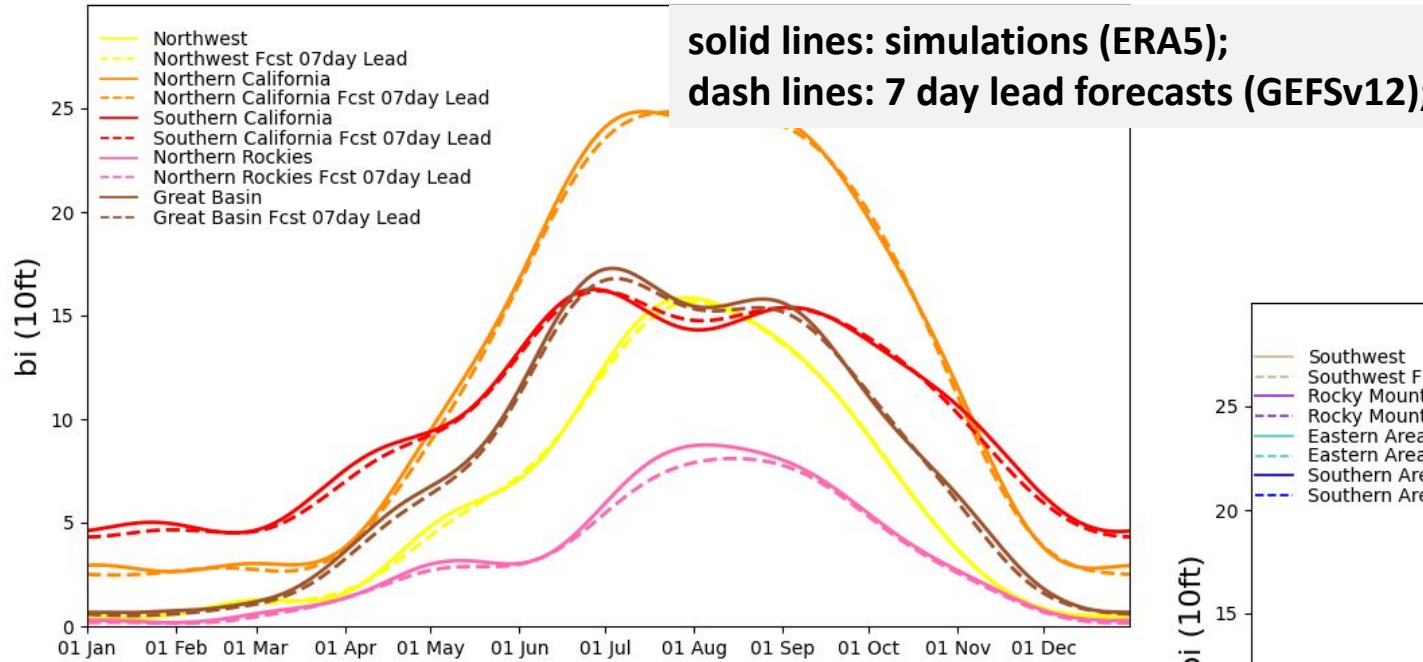
- The fire danger indices are defined by the US Forest Service National Fire-Danger Rating System (NFDRS).
- Fire weather related meteorological fields;
- Forecasts are Updated daily ~12pm.

# Fire Weather Week 2 Forecast Skill Assessment

- Skill in reproducing the fire danger index value:
  - Comparing the fire danger index week2 forecast with that from ERA5 analysis
- Skill in detecting fire events:
  - How well does the fire danger index forecast match the occurrence of actual fires?

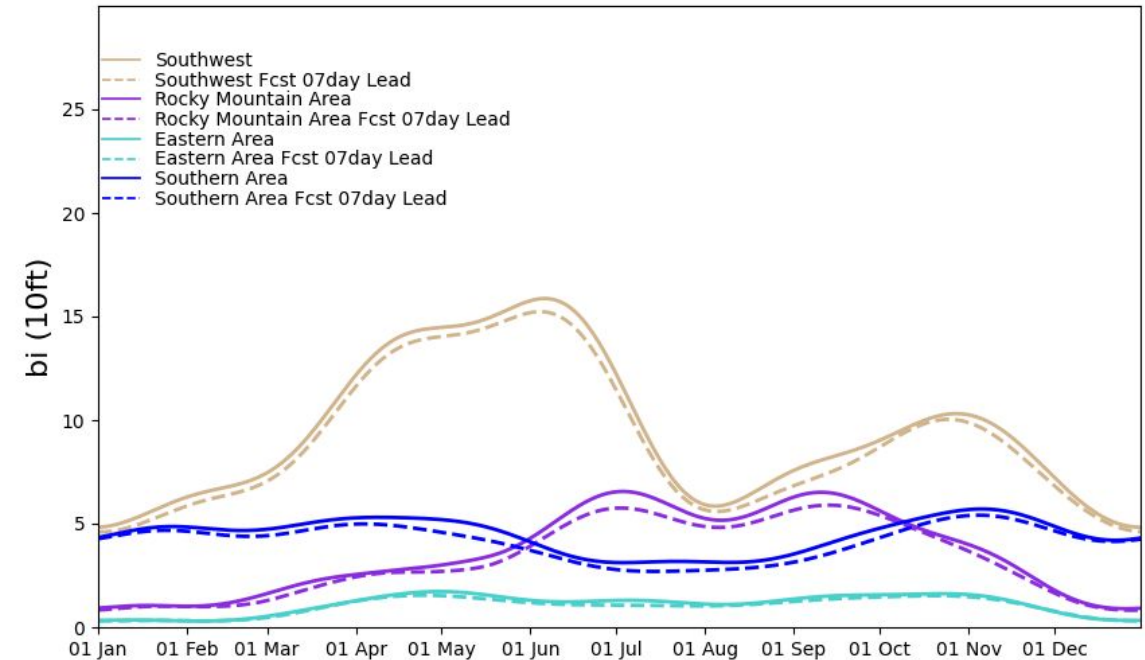
# Skill in Reproducing Burning Index (BI) -- Biases

ERA5 Daily Mean (Clim:2000-2019)  
Burning Index



Geographic Area  
Coordination  
Centers (GACC)

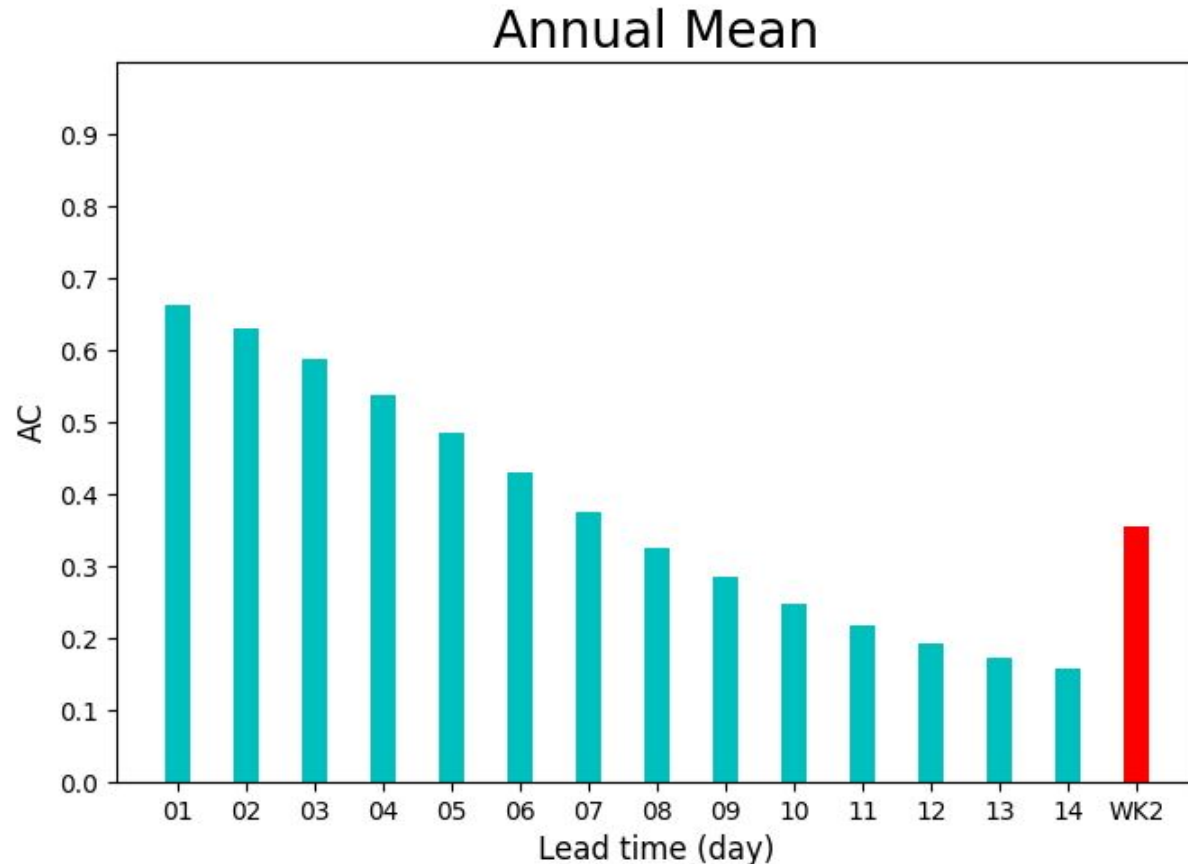
ERA5 Daily Mean (Clim:2000-2019)  
Burning Index



- Forecasts and simulations of the annual cycle of daily burning index.
- Forecasts agree well with the ERA5 simulations;
- Only very small bias.

# Skill in Reproducing Burning Index (BI) -- Correlation

Anomaly Correlation CONUS (daily/week2)  
Burning Index

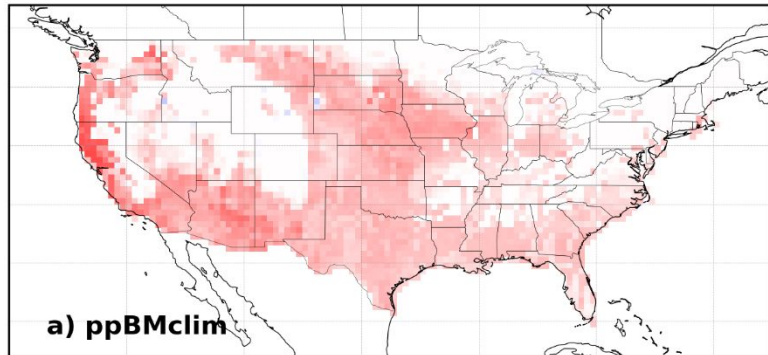


- GEFSv12 vs ERA5, 2000-2019;
- Daily forecast as lead time;
- Week2 forecast (8-14 days);
- Averaged over the CONUS;

# Skill in reproducing Burning Index (BI) -- CRPSS

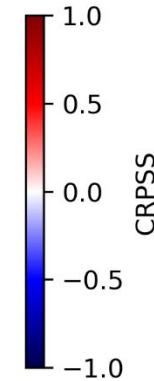
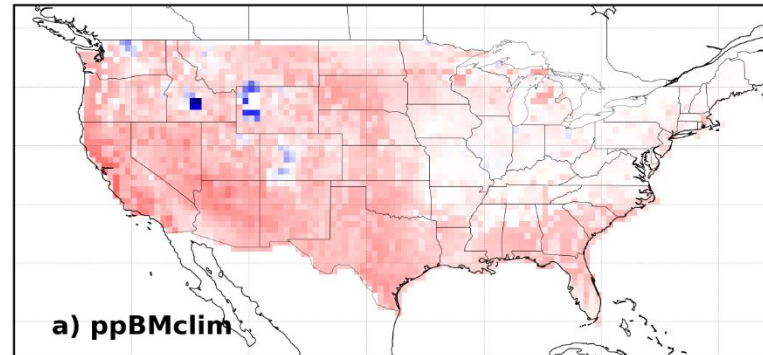
Burning Index

IC=DJF, Lead=Day08\_14



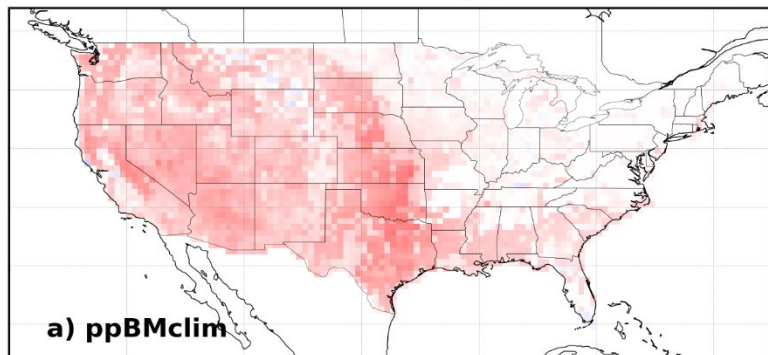
Burning Index

IC=MAM, Lead=Day08\_14



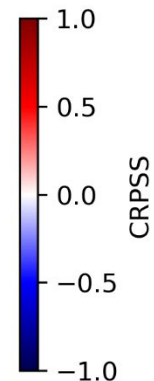
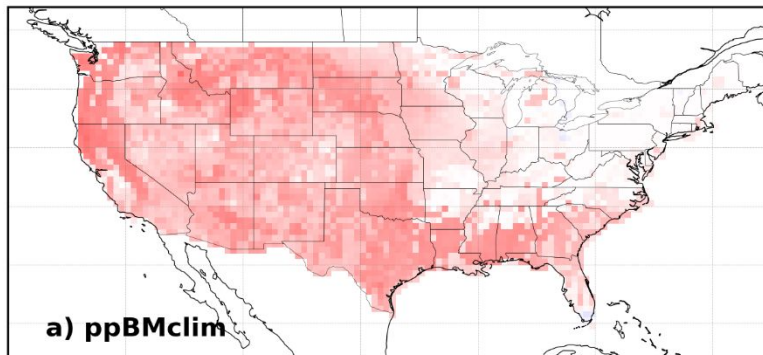
Burning Index

IC=JJA, Lead=Day08\_14



Burning Index

IC=SON, Lead=Day08\_14

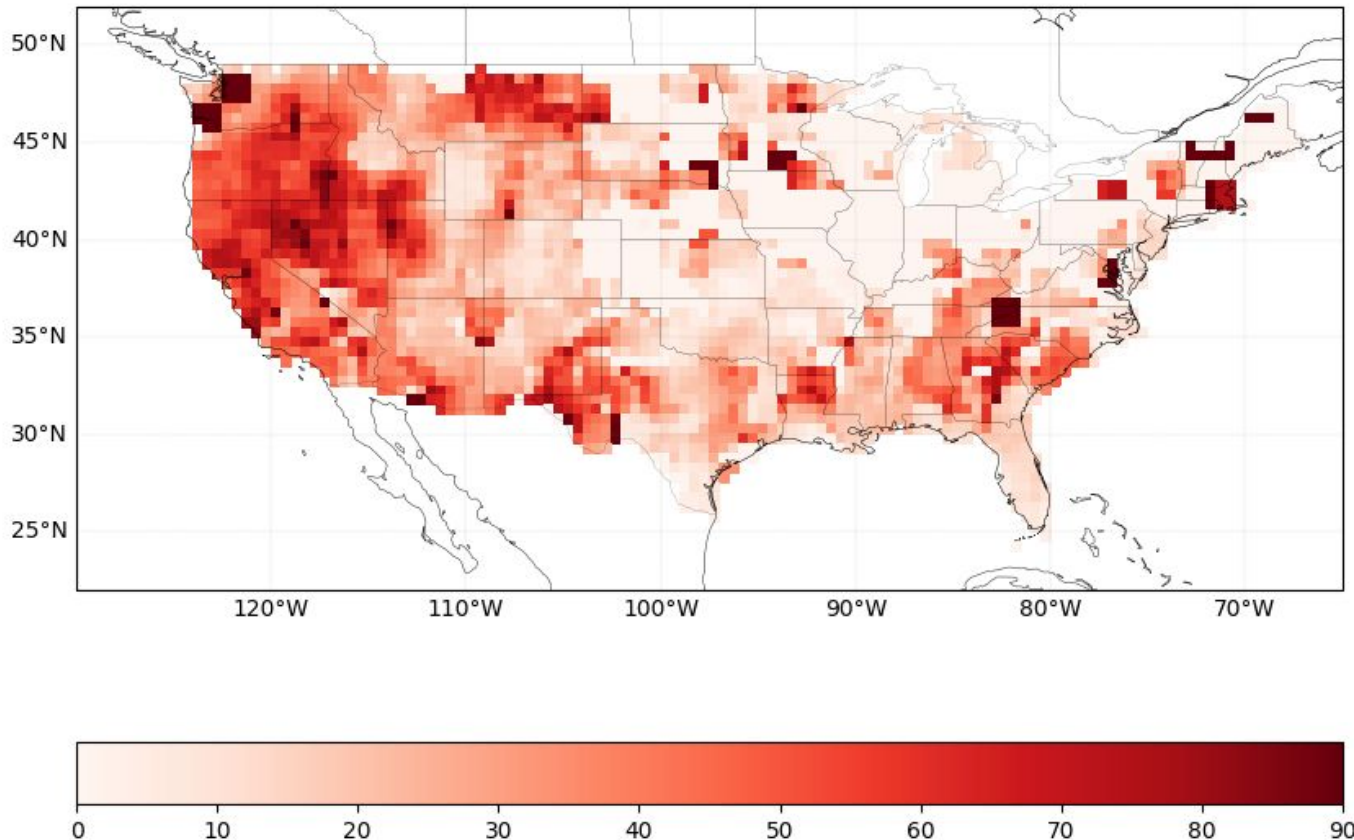


- GEFSv12 2000-2019;
- Benchmark forecast of climatology;
- Week2 forecast CRPSS in each four seasons;
- Skills are generally higher over regions of large BI.



# Skill in detecting fire events -- POD

Probability of Fire Detection  
(GEFSv12 2000-2018 Week2)



- Fires are rare events:  $POD = H/(H+M)$
- $BI \geq 75^{\text{th}}$  percentile defined as forecast fire;
- Observation fire >10 acres defined as observed fire;
- Data source: the USDA Fire Program Analysis Fire-Occurrence Database (FPA\_FOD) 5th Edition;
- POD is  $\geq 50\%$  over the Northwest, California, and Great Basin regions;
- POD is relatively low, where the fire activity is less.

# Summary

- The week 2 fire-weather forecast system forced with **the calibrated GFSv12 meteorological variables** show improved skill of the fire-indicator forecasts relative to the climatological forecasts.
- The week 2 forecasts are able to detect about or greater than 50% fire events over the relative fire active regions.
- The week 2 outlook tool can add potential useful early warning information for fire control strategic planning.